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ABSTRACT

The purpose of this paper is to examine two InterMath pilot workshops and how they were able to meet the goals of learner-centered professional development. The paper focuses on the experiences of the learners, offers insights from each case as well as across cases, and provides suggestions to improve the experience for later learners. The data reported in this paper came only from the workshops and interviews with the teachers and the instructors. Several findings emerged that spanned across both cases. Support and interaction became very intertwined in the cross-case analysis. Another support/interaction issue that appeared was the overwhelming number of procedural questions that were asked by the participants. Finally, while the researchers provided every opportunity for collaborative learning, few teachers chose to engage in it. There were two main barriers across the two cases: technology and goals. The major finding in the cross-case analysis was a disturbing trend among the teachers who implemented the InterMath problems in their classroom to structure the students' learning experience exactly as their workshop experience had been structured. Post survey results indicated that the teachers were not yet comfortable with the implementation. In conclusion, suggestions for improvement for this kind of workshop experience are offered. (Contains 18 references.) (AEF)

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Learner-Centered Professional Development Environments in Mathematics: The InterMath Experience

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Background

The pedagogical shifts embodied in a series of standards published by the National Council of Teachers of Mathematics (NCTM) emphasize a departure from the teaching and learning approaches typical to American classrooms (NCTM, 1989, 1991, 1995, 2000). National and worldwide assessments such as the TIMSS report (Cochran, 1999 and NAEP (U.S. Department of Education, 2001) confirm that there is a need to carefully examine and improve our educational practices in order to remain a leader in worldwide learning and in worldwide industry. In order to meet the needs of the educational system, we need to rethink the role and format of teacher professional development experiences (e.g., NCSMT, 2000; NPEAT, 2000; National Commission on Teaching & America's Future, 1996; Renyi, 1996; Sparks, 1999).

Several leaders in professional development and mathematics have clearly defined a working plan for improving mathematics teachers' content knowledge and pedagogical content knowledge, as these two factors seem to be critical factors in student learning. Calls for professional development that occurs over a long period of time, that emphasizes teacher thinking and development of reflective dispositions, and that pushes teachers to learn more in their content areas have become pervasive in the professional development literature (e.g., Ball, 1994; Hawley & Valli, 1999; Krajcik, Blumenfeld, Marx, & Soloway, 1994). As pointed out by Kilpatrick, Swafford, and Findell (2001):

> Teachers' professional development should be high quality, sustained, and systematically designed and deployed to help all students develop mathematical proficiency. Schools should support, as a central part of teachers' work, engagement in sustained efforts to improve their mathematics instruction. This support requires the provision of time and resources (p. 12). This statement is certainly a call for professional development experiences that depart from the "make and take" model that is commonly associated with teacher workshops.

Based on the growing need for constructivist, learner-centered environments (McCombs & Whisler, 1997), National Partnership for Excellence and Accountability in Teaching (NPEAT) has "revisioned" what professional development should look like and be (NPEAT, 2000). Based on current research, and in alignment with other proposals for improving professional development, the NPEAT Research-Based principles provide a guide for professional development. These principles include:

- The content of professional development (PD) focuses on what students are to learn and how to address the different problems students may have in learning the material.
- Professional development should involve teachers in the identification of what they need to learn and in the development of the learning experiences in which they will be involved.
- Most professional development should be organized around collaborative problem solving.
- Professional development should be continuous and on-going, involving follow-up and support for further learning — including support from sources external to the school that can provide necessary resources and new perspectives.
- Professional development should provide opportunities to gain an understanding of the theory underlying the knowledge and skills being learned. (NPEAT, 2000)

In short, teachers should take charge of their learning, be provided with motivational and challenging ways to learn, and should have the opportunity to decide what is most relevant for their students (Hawley & Valli, 1999). NPEAT also asserts that the most successful professional development occurs in a culture of change.

InterMath

One attempt at creating a professional development environment that aims to meet these goals is the InterMath project. InterMath is comprised of a 15-week technology-rich workshop, a website with mathematical investigations and tools to support learning, an ongoing support system that is designed to provide continued support for teachers who have participated in the workshop, and a number of other tools and opportunities to allow teachers to take away what they need for their own success. InterMath was created to help address a critical problem with middle school mathematics – many of the teachers are not knowledgeable enough in their content area or in content pedagogy (SREB, 1998). This is because of the number of middle grades teachers who are either teaching out of field or who have a generalist background. For many subject areas, the generalist degree does not offer a rich-enough content background for the teachers to support students in the classrooms being called for.

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The goals of InterMath include the improvement of teachers' mathematical skills and knowledge through open-ended explorations; an understanding and ability to use software to support the development of mathematical thinking; and the creation of a community of teachers who support each other in implementing the explorations-based approach in their classroom. In implementation, there is considerable room for teachers to choose their own path to success – they select which problem(s) they want to work in each of the critical content areas; they select the approach they want to use to solve the problem; and ultimately, the teachers decide the depth of learning they take from the class by choosing to explore more challenging problems, or add extensions to the problems.

It is our view that InterMath provides one approach to learner-centered professional development. We provide the workshop across a full semester, but include tools to allow the continuous growth of an online community. The teachers are given considerable freedom to choose the mathematics that is most relevant to their situation, they are provided with a number of tools from which to select, and they decide what is important in each problem when they prepare their write-ups of their work. While many of the teachers who come to InterMath are not necessarily seeking a reform-based approach to mathematics, they leave with a deepened understanding of the aspects of the NCTM standards that help define a quality mathematics experience. In our interviews with teachers, we have also found that they develop their understanding of learning by experiencing this approach.

This Study

The purpose of this paper is to examine two InterMath pilot workshops and how they were able to meet the goals of learner-centered professional development. We focus on the experiences of the learners, offer insights from each case as well as across cases, and provide suggestions to improve the experience for later learners. The data reported here came only from the workshops and interviews with the teachers and the instructors.

These studies were conducted by participant observer graduate students in each workshop. The observers collected field notes and helped the workshop participants. Another observer (Ornill) visited the larger workshop three times during the course as well. In those visits, the goal was to gain a non-participant view of the learning environment.

Other data collected for this study include tape-recorded interviews with several participants (8 in one class, 4 in the other) and both instructors. There were also informal interviews conducted half-way through the course in the larger group. Student work, published on the Web, was also considered as it provided insight into the teachers' mathematical thinking and technology skills. A survey that asked our participants to discuss the importance of and their comfort with using technology in mathematics was also evaluated.

For the purposes of this study, three weeks of fieldnotes were selected from each class. They came from early in the semester (week 2 or 3), mid-semester (week 6), and later in the semester (week 12-14). All students and instructor interviews were considered. Only the webpages for the interviewed students were analyzed.

The analysis process involved coding and sorting data. We found several emergent categories that came up repeatedly and used those as a framework for our thinking. Those included: Support, Interaction, Barriers, Presentation, and Adoption. Each case is briefly discussed below with a cross-case analysis following.

Case 1

Description

One of the two InterMath pilot workshops took place near Atlanta, GA. Throughout the workshop, approximately 26-28 participants were enrolled. These participants were all full-time middle school teachers in the school district and also University of Georgia graduate students seeking a master's or education specialist degree in middle school mathematics education. Even though the participants were all certified to teach mathematics, some were currently teaching subjects other than math. The teachers participated in the InterMath workshop as their first experience in a middle school program cohort established between their school district and UGA's mathematics education department. While being a member of the cohort was by choice (and acceptance), there was no choice of course selection once the teachers joined the cohort.

The workshop instructor was a full-time professor in the mathematics education department at the University of Georgia and also one of the InterMath developers. There were two mathematics education graduate assistants who served as participant observers during the workshop. The project manager, who visited the class three times during the semester to act as an outside observer, also made additional observations.

The workshop took place at the county's board office computer lab. There were approximately 29 computers in the lab. The computers lined three walls of the room to form a U-shape. In the middle of the lab, there were six long tables that faced an overhead projector screen in the front of the room. There were no computers at these middle tables. The participants themselves chose to sit at the long tables, rather than at the computers during the lecture portion of each class period. On the first table, the instructor set up a laptop computer to connect to the projector. He faced the participants, who sat in the latter five rows, as he taught. No students ever sat in the front row.

The class met weekly in the evening. During the first hour portion of each class, the instructor taught in a traditional lecture-style manner. He demonstrated how to explore InterMath problems using software such as Geometer's Sketchpad, NuCalc, and Excel. The instructor asked a few questions during his demonstrations, but there was little student involvement. The class would then shift to the computers to work on problems, write-ups, and webpages. For the remainder of the class, the participants explored the investigations using various software programs and wrote up their findings to post to their individual web pages. The instructor and graduate assistants walked around the room to assist the participants with technological and mathematical questions, as they requested help.

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In our analysis of data, we found the following trends in this setting.

- Over-reliance on the instructor

The participants seemed to perceive the instructor and graduate assistants as experts. They relied on the instructor, rather than each other for technological and mathematical support. Moreover, they seemed to view the main instructor as the "owner" of the class. Even after seeking help from the graduate assistants, the participants often wanted the instructor's approval. For example, one participant was exploring an investigation where he needed to find the maximum volume for a box. The participant asked one of the graduate assistants how he could incorporate technology in the investigation. More specifically, he wanted to know what technology he could use. The graduate assistant discussed some of his options. Instead of exploring these routes on his own and finding multiple representations of the problem, the participant told the graduate assistant that he was going to ask the instructor which way he should explore the investigation. The participant was seeking a "correct process" for solving the investigation from the instructor. He only wanted to explore the problem the way the instructor/ "owner" saw it.

The instructor seemed to put himself in the ownership role through the manner in which he structured the class. He directed the workshop conversations and selected which problems to investigate. He sought little input from the participants about exploring the problems he had chosen. The participants were placed in a passive role during the first half of the workshop. In the observations, many were reported as off-task during the lecture/demonstration portion of the workshop. During the second portion of each meeting, participants chose to work individually on their write-ups with little communication with other participants. Yet, in the interviews, the participants relayed the feeling that there was not enough support available during the workshop. This feeling further illustrates the assertion that the participants did not turn to each other for support, but rather saw the instructors as their only source of support. In observations, the second half of the workshop was described as being very quiet other than the sound of clicking and the graduate assistants talking to the participants. We would have liked to have seen more interaction and collaboration among the students during the entire class period.

- View of InterMath

The data distinguished three categories of the participants' views of the goals and purposes of InterMath. In the first category, participants saw InterMath as a "make and take" activity to take into their middle school mathematics classrooms. They selected investigations for their own use based on the knowledge level of their students, rather than their own knowledge level. Because of this, the participants failed to push themselves to increase their own mathematical understandings. These participants had the misconception that InterMath was for their middle school students, rather than a challenge for themselves personally. This idea influenced problem selection and depth of exploration of a problem, which was evidenced in some of the workshop discussions and by the participants' webpages. In one class, a participant voiced the concern that the investigations seemed very hard for middle school students. The instructor explained that the investigations were meant for the teachers and that the teachers would have to adapt them if they chose to use them with middle school students. Despite this explanation, participants continued to cling to the idea that the investigations were suitable for their middle school students with little modification or thought into how to present such an activity to this age level.

A second group seemed to view InterMath as technology. They wanted to learn how to use the software tools, but took little interest in using the tools to develop mathematical understandings. In workshop observations, these participants became excited when using the technology and learning something new on the computer. However, very little of their focus was placed on learning new mathematical concepts and making connections. For example, during a one of the workshop classes, one of the graduate assistants showed a participant which button to push to display all the Excel functions she might have needed to create a spreadsheet. The participant said something to the nature of "woo-hoo! I'm finally excited about something in here!" This participant apparently wanted the InterMath workshop to teach her to use the technology more efficiently, rather than using it to deepen her understanding of mathematics.

The last group saw InterMath as an opportunity to enhance their mathematical understandings. In the interviews, these participants stressed the learning of mathematics over the learning of the technology. Unfortunately, few participants held this view of InterMath. One explanation may be that the participants seemed to have a low mathematical knowledge base. The participants particularly seemed to experience difficulties in the discipline of geometry and thus had trouble making mathematical connections and multiple representations that were crucial in the investigations. However, these were the students who seemed most interested in further exploration of the mathematics and also the most reflective about their own mathematical ability.

- InterMath adoption to the classroom

Some of the participants had already begun to use InterMath in their classroom before the end of the workshop. Surprisingly, there seemed to be little or no adaptation of the InterMath investigations when the teachers took them into the middle school classroom, as evidenced in workshop observation discussions. This is ironic since a number of teachers mentioned in class that they felt like the InterMath investigations were not appropriate for the middle school level. Late in the semester, one of the participants pulled one of the graduate assistants to the side and shared with her what she had been doing in her middle school classroom. She had assigned her students to choose three InterMath investigations directly from

the website to work on and to write-up in two weeks. Apparently, the participant made no modifications on the investigations for her middle school students. Even more, the participant seemed to make no attempt to guide the students as to which investigations they might attempt. The teacher made no reference to having her middle school students work in cooperative groups, but rather asked that each student turn in their own independent write-up.

The manner in which some of the participants incorporated InterMath into their classrooms is not surprising considering how many participants viewed InterMath as a mathematical development tool for middle school students, but not for themselves. In addition, instructing the middle school students to work independently parallels the way the participants themselves worked through the investigations during the workshop. Many of the investigations were not meant for middle school students, but rather to challenge the middle school teachers' own conceptions of mathematics and how it is taught.

In the post-workshop surveys, most of the participants perceived an increase in their ability to incorporate technology and mathematics in the classroom. However, interviews reveal that the participants felt a need for more pedagogical support in taking InterMath into the classroom.

Case 2

Overview

The UGA pilot of the InterMath workshop was held at a center designed for supporting teacher professional development with technology on the University of Georgia campus. The classroom was made up of four rows of two tables that all faced an overhead screen. Each table held four computers, and an instructor's workstation sat at the back of the room. The workshop met one evening per week during the Spring, 2001 semester.

The class began with seven students; however, by the end of the fifteen weeks, there were only four participants in regular attendance. Two of these participants taught eighth grade pre-algebra and algebra at a rural middle school. The other two participants came from a private middle school; one was a sixth grade mathematics teacher and the other was the technology support person who also had a mathematics education background.

A professor from the mathematics department at the University of Georgia led the workshop, and two graduate assistants, one from UGA's mathematics education department and one from the instructional technology department, attended regularly in order to assist the instructor and participants and to collect research data. A third graduate assistant, also from the instructional technology department, attended the first few workshops and supported the participants in learning web publishing.

What the participants DID learn

There were some overarching successes in this pilot. First, the participants learned how to use technology to create and post write-ups of their mathematical investigations. Specifically, the participants learned how to use computer software that included web composers and FTP clients. On average, the participants posted seven write-ups to the internet. These write-ups often included links to spreadsheets and/or dynamic geometry files.

Second, the participants learned to identify and to appreciate certain aspects of reform-based issues in mathematics teaching and learning. As evidenced through their final interviews, the participants noted the value of problem solving, learning through collaboration and communication, finding multiple solutions and answers, and asking extension questions. For example, when asked what students in an ideal mathematics classroom would be doing, one participant commented, "Well, after all this, problem solving." Another participant said that an ideal classroom to her would be one in which the students are "asking questions and they're showing their classmates what's happening and sharing ideas and thoughts and communicating with each other." A third participant mentioned that the most important things she learned from the InterMath experience were "The importance of thinking and not just computation. ... And collaboration." She also stated, "I've even told my kids that there are lots of ways to find an answer and oftentimes the answer's not the important part." It was clear that mathematics and mathematics education pedagogy were key issues to these participants.

What the participants DID NOT learn

There were also some critical areas in which learning did not occur as expected. Improvement in these areas is a focus in preparing for the next InterMath workshop. First, the participants did not seem to greatly expand their mathematics content knowledge. Approximately 61% of the write-ups posted were about investigations that were taken from the Algebra or Number Concepts units on the InterMath website. These units correspond to the majority of the topics that are covered in middle grades mathematics. Only 25% of the write-ups focused on Geometry problems and only 7% on Data Analysis problems. One participant mentioned that after she and her partner struggled with a problem that was hard, they would simply "close that one up, and we'd do another one." Issues of lack of perseverance and an unwillingness to try new areas, possibly relating to efficacy, were prevalent.

Second, the participants did not become comfortable with using a variety of mathematical software in doing their investigations. Approximately 86% of write-ups indicated that the authors used spreadsheets to help them with the investigations. Not surprisingly, spreadsheets were the only software the teachers had considerable experience with when they began the workshop. Only 18% of write-ups illustrated use of geometry software, and only 4% mentioned the use of graphing software. One participant stated that she and her partner "felt more comfortable using a spreadsheet. And it's just because...that's what we could maneuver better with."

Finally, the participants did not mention any form of proof in their write-ups (it should be noted, however, that the instructor did not emphasize the importance of including proofs in the write-ups). Most of the participants used numeric patterns or

measurements to justify their solutions to the investigations. No one offered any conceptual explanations or tried to rationalize why the numeric patterns or measurements must have given the correct answer. More disturbing, they also did not seek to use extensions to push their thinking and/or their students' thinking further, even though that issue was an explicit focus of the instructor. The instructor commented that even when the participants did write extensions, they never tried to solve them. This fact may relate to the same issues that prevented attempts at difficult problems.

Cross-Case Analysis

Several findings emerged that spanned across both cases. There were also some findings within each case that we were unable to reconcile. For example, we are not sure why we lost three of seven students in Case 2. While they reported they each left for personal reasons, the fact that all three were from one school raises questions about how to keep busy teachers engaged in the experience. We can speculate about the role of groups, the need for proper location, etc.; however, there is no clear way to determine whether that trend is one we need to attend to in future cases.

For our cross-case analysis, we adhered to the findings framework introduced previously. We looked at what we found in each case, what was true in both cases, and what we thought might be a reasonable assertion based on the evidence provided.

Support & Interaction

We found that support and interaction became very intertwined in our cross-case analysis. This fact was because most of the interactions between students and between instructors and students were focused on helping the learners be successful in what they were doing. We noted that there were two distinct kinds of interactions: affective (those aimed at providing positive feedback or other information to keep the students motivated) and intellectual (those interactions that provided the information learners needed in order to move on with the problem on which they were working). Based on our interviews and observations, the affective interactions were particularly important between participants. Several times the learners commented that they felt behind or inadequate until they began talking with the other participants or until they began to find out from the support staff that others were having the same kinds of problems. In more than one case, this "same boat" effect prevented our participants from dropping out of the workshop.

Another support/interaction issue that appeared was the overwhelming number of procedural questions that were asked by the participants. In both workshops, until around the middle of the semester, the questions all focused on how to use particular pieces of software. Later, we saw some movement to more process-oriented thinking, but the procedural questions never faded entirely. This finding raises a number of questions about supporting the teachers in getting the learning that we had hoped for from the workshop and about who needs to provide support and what that support should look like. In Case 1, we had about 30 students with three support people (two graduate assistants and one instructor) in Case 2, we had one instructor, one to two graduate assistants, and another graduate assistant who acted primarily as a researcher, but ended with only four students. Even with, or perhaps because of, this presence of knowledgeable others, the teachers resisted engaging with each other for problem solving, instead turning to those perceived as owning information. This phenomenon leaves an open question about whether the students perceived that InterMath allowed them to understand the theory and skills they were learning – after all, if they still felt they needed to seek instructor guidance rather than relying on themselves or their peers, it is likely that they still held the traditional idea that math is about right answers and that the teacher's role is to have those answers.

Finally, while we provided every opportunity for collaborative learning, few teachers chose to engage in it. Even in those instances where teachers worked as pairs or trios, they tended to each work their own problem and rely on each other only when they were confused or unable to continue. We also found that among the teachers who did work together, almost every group included teachers who worked together in the same schools. These findings combined lead to two insights: first, teachers seem to work with people who they already know and feel safe with; second, teachers are not naturally predisposed to working in groups. This second point may explain many teachers' reluctance to include groupwork in their classrooms– which reinforces the need for the professional development environment to model the desired classroom environment.

Barriers & Difficulties

There were two main barriers across the two cases: technology and goals. The technology problem was one of both participant inexperience with the tools we were using and hardware problems that were exasperated by participant inexperience with the tools. The technology difficulties were so severe that almost half of each workshop was spent with students struggling to make webpages and publish them. This amount of time was particularly alarming given that the webpage aspect of the class was only a tool for portfolio generation. The technologies that were of greatest interest were tools that allowed mathematical visualization and exploration (e.g., Geometer's Sketchpad, Excel, and NuCalc/Graphing Calculator). Further, the web development goal was a tiny one as compared to the mathematical aims of the InterMath experience.

The barrier caused by goals was an interesting one. The problem was that the participant goals and the workshop goals were not always in alignment. In our follow-up interviews and surveys, for instance, a large number of teachers indicated that learning technology was their perceived goal for InterMath. Those who reported this, it should be noted, were also quite happy with their experience. However, that was not our intended goal. What we had hoped was to allow teachers to think about teaching and learning mathematics in a different way – certainly technology was a part of that vision, but not the central component.

Another large group of teachers seemed to think that the InterMath workshop provided an opportunity to become familiar with a tool, the InterMath website, that could be used in middle-grades classrooms. While there were some problems that certainly could be useful for middle school students, the purpose and intention of the site was to enhance teacher mathematical understanding.

Because teachers saw the site as being a tool for use in their own classrooms, many completed only problems they felt their students could complete. This meant that many of them did not challenge their own mathematical abilities at all.

On one hand, because the participants were able to define and follow their own goals, they were pleased with the outcome. On the other hand, we have concerns about the kind and quality of learning given that teachers did not seem concerned with their mathematical development.

Adoption

Our final major finding in the cross-case analysis was a disturbing trend among the teachers who implemented the InterMath problems in their classroom to structure their students' learning experiences exactly as their workshop experience had been structured. This was alarming for a number of reasons. First, it demonstrated little reflection on the part of the teachers about their students' abilities in mathematics. They allowed students to randomly choose problems from sets that covered a number of topics and varied in conceptual difficulty tremendously. Further, the teacher participants had complained throughout the workshop, in both cases, that there was not enough structuring because there were not clear guidelines for assignments, etc. Yet, they reported implementing this same kind of approach for their students who did not have the maturity or life-experience upon which to draw to cope in this extremely open-ended environment. In short, it seemed that the teachers borrowed InterMath rather than adopting it. It may be argued that this is the first step of adoption, but it is complicated because we no longer have the opportunity to support these teachers in their efforts.

Further, post survey results indicated that the teachers were not yet comfortable with the implementation. This was perhaps corroborated by the teachers who talked about using demonstration techniques to implement InterMath in their classrooms or those who said they needed more practice themselves before they could implement. While these problems are somewhat different from the wholesale adoption approach with no attention to philosophy, they still prevent the students from having a successful experience with mathematical explorations.

Conclusion

In conclusion, we offer our suggestions for improvement for this kind of workshop experience.

First, it is vital to the success of the workshop that we solve the technology problem. Unless we find a way to shift teacher focus away from the procedural aspects of using the technology, we will not be able to support them in their content knowledge development. While the learner-centered professional development principles do indicate that teachers should be in charge of setting their goals, it seems critical that the learning of procedure needs to somehow be removed from the prominent position it held in our pilot workshops. Some ways of supporting teachers in the technology area might include setting prerequisites for taking the workshop, creating a forms-driven webpage publishing approach, or rethinking the role of online portfolios in the InterMath experience. We could also provide special technology skills workshops for the participants. From a more systemic view, it seems that schools need to support a higher level of technology literacy among their teachers. All of our participants had completed some kind of basic technology training, yet they did not know how to accomplish their goals either conceptually or procedurally.

For the goal alignment problem there are several potential solutions. First, consistent with the NPEAT standards, more professional development opportunities should be aimed at supporting teacher conceptual development rather than activity generation. Further, we learned that simply telling the participants about the intentions of the workshop was not enough. They need to be challenged through the structuring of the workshop to push themselves. Further, they need to have the opportunity not only to own the goals they are aiming for, but also to own the workshop itself. Participants need to feel that they can work with the instructor(s) to steer the professional development program for their success. Finally, we need to look for ways to let the need for technology arise out of the mathematics so that the teachers first explore what mathematics and mathematical knowledge are, then look for ways to solve the problems. The technology should be one of a host of tools that they are comfortable with and able to use in the learning environment.

Finally, the adoption issue. From our experience in these two classes, it seems reasonable that a first step toward more meaningful adoption by the teachers would be to attack the problem head on – to discuss ways to implement InterMath with the teachers, to look at ways problems might be modified to more appropriately meet the needs of middle school students, and to discuss the value and learning that might come from using the investigations. A second approach might be to model a classroom approach to using the problems with the students. In this way, we would provide a safe environment in which teachers can think through the issues involved with implementation before affecting students. Finally, our ongoing goal of creating a lesson plan database may help with the adoption process. The database will provide InterMath participants with access to tested lesson plans that other teachers have used in their own classrooms.

In conclusion, InterMath offers one view of a research-based professional development endeavor. In our initial implementation we learned much about the successes and pitfalls of working within this kind of framework.

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